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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/241,695	02/02/99	MIYANAGA	A SEL123

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MM22/0214

EXAMINER

HU, S

ART UNIT

PAPER NUMBER

2811

DATE MAILED:

02/14/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/241,695

Applicant(s)

Miyana et al.

Examiner

Shouxiang Hu

Group Art Unit

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☒ Responsive to communication(s) filed on Dec 3, 1999

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11, 453 O.G. 213.

A shortened statutory period for response to this action is set to expire three month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

☒ Claim(s) 1-4, 14, 15, 18, 21, 24, 27, and 28 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-4, 14, 15, 18, 21, 24, 27, and 28 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

— SEE OFFICE ACTION ON THE FOLLOWING PAGES —

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-4, 14-15, 18, 21, 24, 27 and 28 rejected under 35 U.S.C. 103(a) as being unpatentable over Chang.

Regarding claims 1 and 15, Chang discloses (Figs. 1-3) a semiconductor IC device comprising MOSFETs and each of the MOSFETs comprising:

a source region; a drain region; a channel forming region between the source and drain regions;

an impurity region (18 or 28) being added with an impurity having an opposite conductive type to the source and drain regions and being formed under the channel forming region.

Although Chang does not explicitly disclose that the concentration of the impurity in the channel forming region is from 1/100 to 1/10 of that in the impurity region, it is noted that the ratio of impurity concentrations in these two regions in Chang's MOSFETs is in a range substantially covering 1/100 to 1/10, given the disclosed doping dosage and the doping pocket

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broaden range (vertical width) and the typical impurity concentration in a non-heavily doped channel forming region. Besides, the impurity concentration of the impurity region is a well recognized parameter of importance subject to routine experimentation and optimization.

In addition, although Chang does not expressly disclose that the impurity is introduced from a direction of the $\langle 110 \rangle$ axis with respect to the single semiconductor substrate, it is noted that it is old and well known in the art that the MODFET are normally formed with the wafer surface being parallel to the (100) crystal plane and with the channel being quite commonly aligned to $\langle 100 \rangle$ crystal direction. Therefore, the impurity doping direction in Chang's IC device can be presumedly inherently along the $\langle 110 \rangle$ direction, as the arrow direction shown in Fig. 3(c) is about 45 degrees to the vertical. Besides, the exact doping direction for the impurity regions is also a well recognized parameter of importance subject to routine experimentation and optimization

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to make Chang's semiconductor device with the concentration of the impurity in the channel forming region being from 1/100 to 1/10 of that in the impurity region and with the impurity region being doped along the $\langle 110 \rangle$ direction through routine experimentation and optimization, so that faster switch speed and increased punchthrough voltage would be achieved.

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Regarding claims 2-4, the impurity concentrations in the channel forming region and in the impurity region are recognized variables of importance in Chang's disclosure and they are subject to routine experimentation and optimization.

Regarding claims 14, Chang's semiconductor device further comprises a pair of LDD region (14)

Regarding claims 18, 21 and 24, it is noted that it is old and well known in the art that semiconductor devices having MOSFETs with short channels can be used in microprocessors, including RISC or ASIC ones, and can be applied in cellular phones, personal handy phone systems and portable computers. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to make the semiconductor device and apply it to the above areas for achieving improved performance/cost combination in these areas.

Regarding claim 27, Chang further discloses that the peak impurity region is formed at a depth of from 50 to 60 nm (Col. 3, lines 58 and 59).

Regarding claim 28, it is noted that Chang's MOSTEF is a bulk one on silicon substrate; and, bulk MOSFET is normally formed with a single crystal substrate.

Response to Arguments

3. Applicant's arguments filed on September 3, 1999 have been fully considered but they are not persuasive.

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In response to applicant's argument that "there is no disclosure in Chang indicating that the impurity in the alleged channel forming region of Chang is 1/100 to 1/ 10 of that in the impurity region", it is noted that Chang discloses the implantation dosage for the impurity region (18) of about 4×10^{12} atoms/cm² and the vertical width of the impurity region of about 40 nm (Col. 3, lines 49-61), which leads to the impurity concentration (roughly as dosage/width) in the impurity region to be about 1×10^{18} atoms/cm². On the other hand, the non-heavily-doped channel forming region normally has a impurity concentration in a range covering 1×10^{16} to 1×10^{17} atoms/cm². Thus, Chang's disclosure indicates that the ratio of impurity in the channel forming region to that in the impurity region is in a range covering 1/100 to 1/ 10.

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

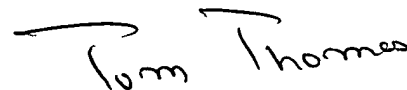
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however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

5. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 or 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to **Shouxiang Hu** whose telephone number is (703) 306-5729. The Examiner is in the Office generally between the hours of 8:00AM to 5:30PM (Eastern Standard Time) Tuesday through Friday.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is (703) 308-0956.



Shouxiang Hu

February 9, 2000

Tom Thomas
Supervisory Patent Examiner
Technology Center 2800